Occupational risk factors for cancer of the pancreas: a case-control study

F Pietri, F Clavel, A Auquier, R Flamant

Abstract

The role of the occupational environment in the occurrence of cancer of the pancreas was analysed in a case-control study of 171 cases of pancreatic cancer and 317 controls matched for age at interview, sex, hospital, and interviewer. The study was conducted in France between 1982 and 1985 and covered 15 important industries and various other occupations. The results are given for the whole population, a subgroup of manual workers (46 cases and 108 controls), and a subgroup of French nationals (114 cases and 253 controls). After adjustment for cigarette smoking, and coffee and alcohol consumption, workers in the food industry (OR = 1·86) and the leather industry (OR = 1·63) showed higher risks than other industries. In the sub-group of French nationals only the risk associated with the textile industry was significantly higher than unity (OR = 2·30). No significant increase in risk was associated with work in any of the other branches studied; printing showed a moderate increase in risk (OR = 1·54). The subgroup of manual workers showed an increase in risk for cancer of the pancreas among those working in the building materials and building trades classification (OR = 2·16) and transportation (OR = 1·57).

Little is known about the aetiology of pancreatic cancer, but the fact that several agents act as carcinogens for the pancreas in laboratory animals suggests that cancer of the pancreas might be associated with some occupational factors. Several industries and occupations have been associated with an increased risk of pancreatic cancer including the chemical industry,[1] petroleum refining,[2–4] the metal industry,[5–10] the rubber tyre industry,[11–13] and the printing industry.[14–15] These associations were mostly deduced from cohort studies, and few case-control studies have been carried out. We report the results of a case-control study conducted in France between 1982 and 1985 on 171 cases of pancreatic cancer.

Unité de Recherches en Epidémiologie des Cancers de l'INSERM (U287), Institut Gustave Roussy, 94805 Villejuif, France
F Pietri, F Clavel, A Auquier
Département de Statistique Médicale, Institut Gustave Roussy, 94805 Villejuif
R Flamant

Subjects and methods

The design of the study had been described elsewhere.[16] The information was collected in seven public hospitals in Paris and was obtained from 105 men and 66 women with cancer of the exocrine pancreas. Each case was matched for sex, age at interview (± five years), hospital and interviewer with two controls, one with cancer located outside the biliary tract, liver, stomach, and oesophagus and the other with a non-neoplastic disease. In all, 317 controls (196 men and 121 women) were interviewed. All the patients agreed to be interviewed. The data were validated by the PIGAS system.[17]

The results are given for the whole population and also for two subgroups (manual workers and French nationals) not defined from matching criteria. Odds ratios (ORs) were derived from unconditional multivariate logistic regression analysis[18] implemented with the BMDP computer package.[19] All ORs were adjusted for matching criteria (age and sex) and confounding factors—namely, origin, educational level, and consumption of coffee, cigarettes, and alcohol.

As no differences were apparent for any of the risk factors studied between the two series of controls, analysis was undertaken with the two control groups combined. For each occupational group, the baseline category was composed of patients who had never been engaged in that particular activity, or who had been engaged in it for less than one year.

Results

The group of cases and the group of controls were first considered as a whole; the distribution of occupational categories did not significantly differ between the two groups. The highest risk was observed among the liberal professions and senior executives (OR = 1·87, 95% confidence interval

Table 1 Unconditional ORs† for pancreatic cancer among all workers studied in major occupational groups

	No of cases‡	No of controls‡	OR (95% CI)
Agriculture	14	33	0·85 (0·43–1·71)
Energy-metallurgy:	13	30	0·84 (0·41–1·71)
Petroleum industry	3	0	— —
Metallurgy	7	17	0·82 (0·32–2·07)
Mechanical engineering	11	27	0·86 (0·40–1·82)
Industries:	31	52	1·21 (0·71–2·05)
Glass and ceramics	0	5	— —
Building materials, building trades	18	25	1·41 (0·69–2·89)
Chemicals	2	5	0·93 (0·17–5·02)
Rubber and asbestos	1	0	— —
Food	8	9	1·86 (0·69–5·07)
Textile and leather:	27	35	1·69 (0·94–3·05)
Textiles	21	26	1·87 (0·97–3·63)*
Leather	5	5	1·63 (0·43–6·08)
Furnishing and publishing	14	32	0·84 (0·43–1·66)
Wood and paper industry	6	20	0·57 (0·22–1·49)
Printing	8	12	1·32 (0·51–3·41)
Jewellery	0	2	— —
Transportation	13	31	0·87 (0·42–1·77)
Trade	26	72	0·64 (0·39–1·07)
Administration and various occupations	83	156	0·87 (0·58–1·31)

*p = 0·07.
†Odds ratios adjusted for age, sex, foreign origin (yes/no), educational level (number of years spent at school: <4, 5–7, 8–13, ≥14), daily consumption of coffee (number of cups a day), cigarettes (average number a day), and alcohol (weekly number of glasses).
‡Total exceeding 171 subjects as the same subject could be employed in several categories.

= 0·92–3·79) and the lowest risk among manual workers (OR = 0·73, 95% CI = 0·46–1·58).

Table 1 shows the ORs for pancreatic cancer among workers in the main occupational groups. Subjects were considered as exposed in an occupation when they had been employed in it for at least one year.

None of the risks was significant. The highest risks were for workers in the building materials and building trades group, the food industry, the textile industry, and the leather industry. Risks associated with workers in other groups were mostly less than one. When ORs were estimated for durations of occupation of 15 years or less and for more than 15 years there was no evidence that long term exposure affected the risk.

The second stage dealt with two subgroups. The first was comprised of 46 cases and 108 controls who had been employed for at least one year as manual workers and were therefore the most exposed to potential carcinogenic agents. In this subgroup the various occupations were coded according to the International Standard Classification of Occupations.[20] No occupations were significantly associated with pancreatic cancer (table 2). The highest risks were found for workers in the building materials and building trades group and the food industry. Increased risks also appeared among workers in the textile and transportation industries. A reduction of the risk with borderline significance emerged among workers in the wood and paper industries.

In the total population there were significantly more cases than controls who were not of French origin; the foreign nationals had a high educational level and belonged to occupational categories not generally exposed to toxic agents. Therefore, a second subgroup was considered. This consisted of French nationals and included 114 cases and 253 controls. In this subgroup a significantly increased risk was found for workers in the textile industry; non-significantly increased risks were also found for workers in the building materials and building trades group, the food industry, the leather industry, and the printing industry (table 3).

Interactions between the different occupations and three possible risk factors for pancreatic cancer—alcohol and tobacco and coffee intake—and interactions within the different occupations were not significant.

Discussion

Our study confirmed the results of some others. For instance, Magnani and colleagues found a non-significant doubling of the risk for pancreatic cancer among workers in the food industry, especially among subjects exposed to frozen food[21] (although Pickle and Gottlieb did not confirm this).[22] Our study also showed an increase in risk for workers in the food industry among the different groups particularly manual workers for whom it was four times greater. The few manual workers concerned, however, were in various branches of the food industry including bakery, the meat trade, distilleries, grain and flour industries, and other unspecified branches, and not specifically dealing with frozen food.

The leather industry showed a trend towards an increased risk for the group as a whole and for French nationals. The risk was not estimated for manual workers because only two controls were included. The result corroborates previous findings that showed a significant threefold risk among leather tanners.[23] Tanners are exposed to chromium, which is a recognised carcinogen, and this may be responsible for the increased risk, although such exposure is not thought to be specifically responsible for gastrointestinal cancer.

Printing produced a high though non-significant risk among French nationals; a small increase for the group as a whole; and a reduced risk among manual workers. Significantly increased risks have been reported among pressmen,[14 15] and a non-significant doubling of the risk was found among workers in the paper and printing industries.[21] Printing inks, several of which contain known or suspected carcinogens, as well as oil mist and certain solvents might be responsible.[14 15]

Table 2 Unconditional ORs† of pancreatic cancer among manual workers in major occupational groups

	No of cases	*No of controls*	*OR (95% CI)*
Energy metallurgy: (groups 7·1, 7·2, 8·2, 8·3, 8·5)‡	7	18	1·00 (0·36–2·81)
Petroleum industry	1	0	— —
Metallurgy	5	13	0·93 (0·29–3·02)
Mechanical engineering (group 8·4)	6	14	1·39 (0·47–4·14)
Industries: (groups 7·7, 7·8, 8·7, 8·9, 9·0, 9·3, 9·5)	19	32	1·80 (0·78–4·15)
Glass and ceramics	0	3	— —
Building materials, building trades	13	20	2·16 (0·76–6·14)*
Chemicals	0	3	— —
Food	4	2	4·83 (0·76–30·66)**
Textile and leather: (groups 7·5, 7·6, 7·9, 8·0)	10	18	0·99 (0·32–3·06)
Textiles	10	15	1·61 (0·48–5·33)
Leather	0	2	— —
Furnishing–publishing (groups 7·3, 8·1, 9·1, 9·2, 9·4)	5	24	0·38 (0·13–1·11)***
Wood and paper industry	2	15	0·27 (0·06–1·27)***
Printing	3	7	0·78 (0·18–3·41)
Jewellery (group 8·8)	0	2	— —
Transportation (group 9·8)	5	9	1·57 (0·45–5·39)
Trades (Manual workers and foremen in unspecified trades)	4	9	0·99 (0·27–3·58)

*p = 0·15, **p = 0·08, ***p = 0·06.
†See table 1 for details.
‡Groups classified according to the International Standard Classification of Occupations (ISCO–1968).

The increase in the risk of pancreatic cancer found among workers in the petroleum industry, represented by three cases but no control, agrees with results previously reported.[2-4 24] It is difficult to interpret, however, as two of the three cases smoked more than 20 cigarettes a day, and had experienced low levels of exposure to petroleum.

Some published types of exposure were not considered risk factors but were associated with a risk higher than one in our study—for instance, the increased risks in the building materials and building trades group in the whole population and both subgroups. It is difficult to relate this to specific factors because these trades involve many different types of exposure.

Table 3 Unconditional ORs† of pancreatic cancer among French nationals in major occupational groups

	No of cases	*No of controls*	*OR (95% CI)*
Agriculture	11	24	1·14 (0·52–2·49)
Energy-metallurgy:	8	23	0·84 (0·35–1·99)
Petroleum industry	2	0	— —
Metallurgy	5	12	1·02 (0·34–3·05)
Mechanical engineering	8	24	0·77 (0·33–1·83)
Industries:	19	38	1·16 (0·62–2·17)
Glass and ceramics	0	4	— —
Building materials, building trades	9	14	1·51 (0·60–3·78)
Chemicals	2	5	0·96 (0·18–5·18)
Food	6	7	1·89 (0·60–5·94)
Textile and leather:	19	27	1·88 (0·95–3·74)
Textiles	17	21	2·30 (1·09–4·83)*
Leather	2	3	1·42 (0·22–9·10)
Furnishing–publishing:	11	25	0·99 (0·46–2·13)
Wood and paper industry	4	15	0·63 (0·20–1·96)
Printing	7	10	1·54 (0·55–4·33)
Jewellery	0	1	— —
Transportation	11	25	0·93 (0·43–2·04)
Trade	17	58	0·61 (0·33–1·12)
Administration and various occupations	56	129	0·86 (0·53–1·38)

*p = 0·03.
†See table 1 for details.

The textile industry also emerged as a risk factor for pancreatic cancer with a significant risk among the French nationals, a result at variance with other reports; in a case-control study covering 46 types of industry in Los Angeles, fewer observed than expected cases of pancreatic cancer (23 *v* 27) were found among workers in the textile and clothing industries.[25] In a case-control study of occupation and five cancer sites a non-significant excess risk of pancreatic cancer was associated with the textile industry, according to the 1968 Classification of Industries,[21] although when assessed using the register general's 1966 classification of occupations the risk was equal to one.

Some occupations exhibited a decrease in risk of pancreatic cancer, with borderline significance among manual workers—for instance, in the wood and paper industries. In the absence of physiopathological explanations this result is possibly due to chance.

Among previous studies, only one appears to have taken smoking into account as a confounding factor[25]; smoking is the most consistent risk factor, with an approximate doubling of the risk for pancreatic cancer in heavy smokers. As the amount of cigarette

smoking varies with occupational status[26] it was taken into account in our study.

Cases and controls differed as regards origin and educational level. The overrepresentation of foreigners was probably due to a selection bias resulting from foreigners with sufficient means coming to be treated in France; one of the present study's recruitment centres, the Saint-Antoine hospital, is famous for its treatment of cancers of the digestive tract. The higher educational level found among the cases compared with controls, both among the population as a whole and in the subgroup of foreigners, supports this assumption. An overadjustment that might mask a possible association between pancreatic cancer and occupation could have occurred in our analysis when the educational level was considered as a confounding factor, as this is correlated closely with occupational category. It seems unlikely, however, because crude ORs did not differ greatly from adjusted ORs.

The overrepresentation of liberal professions and senior executives among the cases and of manual workers among the controls appears to contradict the hypothesis that occupational exposure has a role in pancreatic cancer in so far as senior executives are less exposed to toxic agents than manual workers. These overrepresentations are, however, probably a consequence of the same bias as that referred to above; foreigners coming to France for treatment are more likely to include members of the liberal professions and senior executives than members of categories with smaller incomes.

Requests for reprints to: Françoise Clavel, INSERM U287, Institut Gustave Roussy, Rue Camille Desmoulins, 94805 Villejuif, France.

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Accepted 28 November 1989